

1. Record Nr.	UNINA9910830038203321
Titolo	Chemically modified carbon nanotubes for commercial applications // edited by Jeenat Aslam, Chaudhery Mustansar Hussain, and Ruby Aslam
Pubbl/distr/stampa	Wiesbaden, Germany : , : Wiley-VCH, , [2023] ©2023
ISBN	3-527-83879-1 3-527-83881-3 3-527-83880-5
Descrizione fisica	1 online resource (539 pages)
Disciplina	620.115
Soggetti	Carbon nanotubes
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Cover -- Title Page -- Copyright -- Contents -- Preface -- About the Editors -- Part I Chemically Modified Carbon Nanotubes: Overview, Commercialization, and Economic Aspects -- Chapter 1 A Detailed Study on Carbon Nanotubes: Properties, Synthesis, and Characterization -- 1.1 Introduction -- 1.2 Evolution of Carbon: Graphite to CNTs -- 1.2.1 Graphite -- 1.2.2 Diamond -- 1.2.3 Graphene -- 1.2.3.1 Direct Lattice -- 1.2.3.2 The Reciprocal Lattice -- 1.2.4 Carbon Nanotubes -- 1.2.4.1 SWNTs: Types and Structure -- 1.2.4.2 Chirality -- 1.2.4.3 Electronic Properties of CNTs -- 1.2.4.4 Optical Properties of CNTs -- 1.2.4.5 Chemical Properties of CNTs -- 1.2.4.6 Defects in CNTs -- 1.2.4.7 CNTs Properties Modification by Chemical Functionalization Process -- 1.2.4.8 Applications of CNTs -- 1.2.4.9 Synthesis of CNTs -- 1.2.4.10 Analysis of CNTs by Raman Spectroscopy -- 1.3 Conclusion -- Declaration of Competing Interest -- Companies Dealing with Chemically Modified CNTs -- Acknowledgments -- References -- Chapter 2 Surface Modification Strategies for the Carbon Nanotubes -- 2.1 Introduction -- 2.2 Classification of Carbon Nanotubes and Their Fabrication -- 2.2.1 Arc Discharge Method -- 2.2.2 Laser Vapor Deposition -- 2.2.3 Chemical Vapor Deposition (CVD) -- 2.3 Purification of CNTs -- 2.4 Surface Modification of CNTs -- 2.4.1 Methods of Functionalization -- 2.4.2

Noncovalent Functionalization -- 2.4.3 Covalent (Chemical) Functionalization -- 2.4.3.1 DefectGroup Functionalization -- 2.4.3.2 Sidewall Functionalization -- 2.4.3.3 CNTs Functionalized with Polymer -- 2.4.3.4 CNTs Functionalized with Biomolecules -- 2.4.3.5 CNTs Functionalization with Ionic Liquid (ILs) -- 2.4.3.6 Plasma Activated CNTs -- 2.5 Characterization of CNTs -- 2.6 Conclusion -- References. Chapter 3 Latest Developments in Commercial Scale Fabrications for Chemically Modified Carbon Nanotubes -- Abbreviations -- 3.1 Introduction -- 3.2 Industrial Scale Fabrication Strategies -- 3.2.1 Basic Chemical Vapor Deposition (CVD) Process -- 3.2.1.1 Industrial Level Fabrication of CNT Through Various CVD Methods -- 3.2.1.2 High Pressure Chemical Vapor Deposition -- 3.2.1.3 AtmosphericPressure Chemical Vapor Deposition (APCVD) -- 3.2.1.4 LowPressure Chemical Vapor Deposition (LPCVD) -- 3.3 CVD on the Basis of Reactor Wall Temperature -- 3.3.1 HotWall Chemical Vapor Deposition (HotWall CVD) -- 3.3.2 ColdWall Chemical Vapor Deposition (ColdWall CVD) -- 3.4 ArcDischarge -- 3.5 Laser Vaporization -- 3.6 Other Synthesis Methods -- 3.7 Applications -- 3.7.1 Transistors -- 3.7.2 Conductor -- 3.7.3 Composites -- 3.7.4 Aerogels -- 3.8 Future Scope -- 3.9 Conclusion -- Conflict of Interest -- Other Sources -- Acknowledgments -- References -- Chapter 4 Economical Uses of Chemically Modified Carbon Nanotubes -- 4.1 Introduction -- 4.2 Properties of Carbon Nanotubes -- 4.3 Synthesis of Carbon Nanotubes -- 4.4 Functionalization of Carbon Nanotubes -- 4.5 Characterization/Analysis of Functionalized Carbon Nanotubes -- 4.6 Economy of Carbon Nanotubes -- 4.7 Economic Importance of Carbon Nanotubes -- 4.8 Hydrogen Fuel Cells -- 4.9 Water Splitting -- 4.10 DyeSensitized Solar Cells -- 4.11 Quantum Dot Solar Cells -- 4.12 SiliconBased Solar Cells -- 4.13 Thermoelectric Fabrics -- 4.14 Cost of Carbon Nanotubes -- 4.15 Globalization of Carbon Nanotubes -- 4.16 Conclusion -- References -- Part II Chemically Modified Carbon Nanotubes: Energy and Environment Applications -- Chapter 5 Chemically Modified Carbon Nanotubes in Energy Production and Storage -- Abbreviations -- 5.1 Introduction -- 5.2 Production of Carbon Nanotubes. 5.3 History of Energy Storage Devices and Materials -- 5.4 Carbon Nanotubes for Energy Storage -- 5.4.1 Carbon Nanotube Hybrid for LithiumMetal Batteries -- 5.4.2 Wearable Energy Storage with Fiberic Carbon Nanotube -- 5.4.3 Carbon Nanotube Hybrid for Supercapacitor Energy Storage -- 5.4.4 Carbon Nanotubes/Biochar for Energy Storage -- 5.5 Present and Future of Carbon Nanotubes -- 5.6 Commercial Scale Application of Chemically Modified CNTs for Energy Storage -- 5.7 Companies Produced CNTs for the Application of Chemically Modified Carbon Nanotubes for Energy Storage -- References -- Chapter 6 Chemically Modified Carbon Nanotubes for Pollutants Adsorption -- 6.1 Introduction -- 6.2 Chemically Modified CNTs -- 6.3 Chemically Modified CNTs for Adsorptive Removal of Pollutants -- 6.3.1 Organic Dyes -- 6.3.2 Removal of Pharmaceuticals -- 6.3.3 Other Organic Pollutants -- 6.3.4 Metal Ions -- 6.4 Influencing Factors -- 6.5 Adsorption Mechanisms of Chemically Modified CNTs -- 6.6 Modified CNTBased Materials Toward Commercialization -- 6.7 Conclusion and Future Perspectives -- Acknowledgments -- References -- Chapter 7 Chemically Modified Carbon Nanotubes in Removal of Textiles Effluents -- 7.1 Introduction -- 7.2 History of Removal of Textiles Effluents -- 7.3 Chemically Modified Carbon Nanotubes -- 7.3.1 Chemical Properties -- 7.3.2 Modification Through Chemical Reduction of Diazonium Salts -- 7.4 Dyes Removal Techniques -- 7.5 Adsorption -- 7.6 CarbonBased Nanoadsorbents -- 7.7 Carbon Nanotubes -- 7.8

Carbon Nanotubes as an Adsorption of Dye Molecules -- 7.9 Industrial Application of Synthetic Dyes -- 7.10 Conclusion -- Acknowledgment -- References -- Chapter 8 Chemically Modified Carbon Nanotubes in Membrane Separation -- 8.1 Introduction -- 8.2 Carbon Nanotubes (CNTs) Overview -- 8.3 Method of Synthesis of Carbon Nanotube (CNT) -- 8.3.1 Arc Discharge. 8.3.2 Laser Ablation -- 8.3.3 Chemical Vapor Deposition (CVD) -- 8.3.4 Hydrothermal -- 8.3.5 Electrolysis -- 8.4 Fabrication Methods of CNTs -- 8.4.1 Fabrication of CNT Reinforced Metal Matrix Composites (CNT MMCs) -- 8.4.2 Microwave Assisted Fabrication of CNTs -- 8.5 Functionalization of CNTs -- 8.6 Chemically Modified Derivatization of CNTs -- 8.6.1 Electrochemically Assisted Covalent Modification -- 8.7 Polymer Grafting -- 8.8 Carbon Nanotubes Enhanced with Nanoparticles -- 8.9 Advantages of CNTs -- 8.10 Challenges in CNTs -- 8.11 Applications of CNTs as Membrane Separation -- 8.11.1 Water Treatment -- 8.11.2 Air Filtration -- 8.11.3 Energy Storage: Capacitors and Batteries -- 8.11.4 Electrochemical Separation and Catalysis -- 8.11.5 Electronic Devices Fabrication -- 8.11.6 Environment -- 8.11.7 Biology and Agriculture -- 8.12 Commercial Scale of Chemically Modified CNTs in Membrane Separation -- 8.13 Future Insights -- 8.14 Conclusion -- References -- Chapter 9 Chemically Modified Carbon Nanotubes for Water Purification System -- Abbreviations -- 9.1 Introduction -- 9.2 History of Water Purification Methods -- 9.3 Carbon Nanotubes CNTs Types -- 9.4 Vital of Modification of CNTs -- 9.5 Surface Modified CNTs for Water Purification -- 9.6 Polymer/CNTs Grafting for Water Purification -- 9.7 Bulk Modified CNTs for Water Purification -- 9.8 Important of Carbon Nanotubes for Water Purification -- 9.9 Conclusions and Future Research Directions -- 9.10 Commercial Application of Chemically Modified CNTs in Water Purification -- 9.11 Companies Produced CNTs for the Application of Chemically Modified Carbon Nanotubes for Water Purification System -- References -- Part III Chemically Modified Carbon Nanotubes: Electronic and Electrical Applications -- Chapter 10 Chemically Modified Carbon Nanotubes for Electronics and Photonic Applications. 10.1 Introduction -- 10.2 Chemical Modifications of CNTs -- 10.2.1 Oxidative Functionalization of CNTs -- 10.2.2 Polymer/Ionic Liquid Modification of Oxidized CNTs -- 10.2.3 Direct Covalent Modification of CNT -- 10.2.4 Heteroatom Doping of CNTs -- 10.2.5 Charge Transfer/Noncovalent Doping of CNTs -- 10.3 Chemically Modified CNTs in Electronics -- 10.3.1 Transistors -- 10.3.2 Rectifying Diodes -- 10.3.3 Bioelectronics -- 10.4 Chemically Modified CNTs in Photonics -- 10.4.1 Organic Photovoltaics (OPV) -- 10.4.2 Organic Light Emitting Diodes (OLEDs) -- 10.4.3 Touch Panels -- 10.5 Summary and Future Scope -- References -- Chapter 11 Chemically Modified Carbon Nanotubes for Electrochemical Sensors -- 11.1 Introduction -- 11.2 Functionalization of Carbon Nanotubes Toward Sensors -- 11.2.1 Covalent Functionalization of CNTs Toward Sensing -- 11.2.2 Noncovalent Functionalization of CNTs Toward Sensing -- 11.2.3 Polymers Wrapping of CNTs Toward Sensing -- 11.2.4 CNTs Decorated with Metal Nanoparticles Toward Sensing -- 11.3 Electrochemical Sensing Applications of CNTs -- 11.3.1 CNT Based Sensors for Environment Protection -- 11.3.2 CNT Based Sensors for Pharmaceutical Applications -- 11.3.3 Monitoring of Biomolecular Compounds -- 11.3.3.1 Glucose Sensor -- 11.3.3.2 DNA Sensor -- 11.3.4 CNTs Based Sensors for Real Sample Analysis -- 11.4 Summary and Outlook -- References -- Chapter 12 Chemically Modified Carbon Nanotubes for Lab on Chip Devices -- Abbreviations -- 12.1 Introduction -- 12.2 Allotropes of Carbon -- 12.2.1 Diamond --

12.2.2 Graphite -- 12.2.3 Fullerenes -- 12.2.4 Carbon Nanotubes --
12.2.4.1 SWCNT: Various Synthesis Methods -- 12.2.4.2 Growth
Catalysts for SWCNT -- 12.2.4.3 Approach of Introducing the Catalyst
on SWCNTs (CVD) Growth -- 12.2.5 DoubleWalled Carbon Nanotubes
(DWCNTs) -- 12.2.5.1 Development of DWCNTs.
12.2.5.2 Purification of DWCNTs.
